REMARKS

In this Office Action, the Examiner objects to the disclosure because the present patent office practice is to insist that the claims begin with the statement "I (or we) claim". Therefore, correction has been made as requested.

In the substantive examination of the claims, claims 1-25 were rejected. Specifically, claims 1 and 7 and 21-25 were rejected under 35 USC 102 as anticipated by Duluk US 6,288,730. Claims 1, 4, and 12-16 were rejected under 35 USA 103 as obvious in view of Duluk '730 taken with Duluk 6,771,264. Claims 2, 3, 5, 6, and 17-19 were rejected under 35 USC 103 as obvious in view of Duluk '730 and Duluk '264 considered with Holmes US 6,490,635. Holmes is cited for a teaching of updating a conflict detection unit when the write to a location is completed. Claims 8, 10 and 11 are rejected under 35 USC 103 as unpatentable over Duluk '730 considered with Wood US 6,204,856. Wood is cited as teaching depth buffering prior to shading. Claim 9 is rejected under 35 USC 103 as unpatentable over Duluk '730 and Wood '856 considered further with Icehard US 2004/207623. Icehard is relied on for teaching depth pealing. Finally, claim 20 is rejected as unpatentable over Duluk '730 and Duluk '264 in view of Aglietti US 6,567,907, which is cited as teaching a conflict detection unit including a hash unit. These rejections are respectfully traversed.

Claims 2, 3, 10 and 21-25 are cancelled. New claims 26-32 are submitted and, together with the pending claims, are patentable over the cited art.

Duluk '730, on which the Examiner relies as a primary basis for rejecting all of the claims, does teach a fragment processor and a conflict detection unit; however, the conflict detection unit of Duluk '730 operates in a fundamentally different way then the conflict detection method and apparatus disclosed and claimed herein. The other references cited by the Examiner do not make up for this fundamental deficiency. In particular, the other reference that teaches a conflict detection unit, Holmes '635, teaches a fundamentally different conflict detection unit from Duluk and is selected from an art that is non-analogous to that claimed in the present application. There would be no motivation to select the Holmes teaching or to combine the two references since

such a combination would combine two fundamentally different conflict detection units in a manner which no person of skill in the art would be motivated to adopt.

The present invention is directed to method and apparatus based on a graphics processor configured to avoid read after write (RAW) hazards-also termed position conflicts. Prior to executing program instructions on a fragment, a fragment processing unit within a programmable graphics processor checks if there are any position conflicts. A (RAW) hazard exists when there is a pending write operation to a memory location, and a currently executing program instruction requires data to be read from that memory location. If there are no position conflicts for a pending instruction, the fragment processing unit initiates processing of the fragment. When the fragment enters and goes through the processing pipe line, each destination location that is written when the fragment is processed is entered into the position conflict unit. During processing, when the fragment has completed the write to one or more destination locations, the position conflict unit is then updated. Consequently, fragment data written to graphics memory by the fragment processing unit is read without flushing the processing pipeline.

On the other hand, if an instruction is ready for execution, and the conflict detection unit determines that executing the instruction requires data that is the subject of a read after write hazard, then the instruction or a reference to the instruction is stored in the conflict detection unit, and the next instruction is taken up for processing. When the read after write hazard has cleared, by the necessary data having been stored in the buffer, then the stored instruction is taken up for execution.

In other features of the invention, depth processing and depth peeling may also be taken into account by the conflict detection unit relative to the fragment being processed. While checking for conflicts, the conflict detection unit may also look at whether any depth processing issues would eliminate the need for processing the fragment. Comparison of the depth of the fragment to depth data stored in the buffer which cooperates with the fragment processor may indicate that the fragment will not appear in the display. If so, then processing of the fragment pursuant to the instruction is ended, and the next subsequent instruction is processed.

In stark contrast, in Duluk's '730, on which the Examiner primarily relies, at col. 14, clearly teaches that if a conflict is detected by conflict detection block, the conflicting

address is sent to a conflict queue, with the conflicting instruction only being executed when the instruction reaches the end of that queue. This is completely different from the present invention, wherein the instruction is stored, in a buffer controlled by the conflict detection unit, and executed when the conflict is actually cleared. As noted in multiple places in the present application, a RAW hazard exists when there is a pending write to a destination location that stores data to be read during an instruction execution. The claimed conflict detection unit is updated when the pending write delayed to the destination location is completed, and the delayed instruction is then executed. Thus, the claimed invention advantageously does not experience the stalls which occur in the Duluk '730. Further, the second Duluk patent '264 is not alleged to cure any of the deficiencies in the manner in which conflict avoidance is implemented in Duluk '730, and therefore the combination cannot prevent patenting of the claims.

The Examiner further relies on Holmes. However, Holmes only adds a teaching that the tracking unit enters the location associated with a pending write in the conflict detection unit (col. 3) and updates the conflict detection unit when the pending write to the location is completed. In the first place, the Holmes patent is drawn from an unrelated art, i.e., handling conflicts in a disk drive controller. There is no evidence of record to indicate that a person faced with the problem of executing commands in a graphics processor where the same data must be processed and reprocessed to properly process pixels would turn to disk drive controller art for a solution of the problem. Further, a person who did happen to read the Holmes patent would note that the Holmes patent is intended to order commands in a specific sequence and therefore would not to be driven to make any modification to the Duluk '730 patent conflict detection unit based on the teaching of Holmes. Hypothetically, if Holmes were added to Duluk, then even though note may be taken that the conflict is cleared, there is no reason why anyone would also modify the Duluk design to withdraw the conflicted instruction from the queue and execute it immediately once the conflict clears, as disclosed and claimed in the present application. Further, such a change would constitute a complete redesign of Duluk '730, with no motivation for such a redesign being provided by the Holmes reference cited.

In view, of these clear and emphatic distinctions, as well as the failure of the other references cited by the Examiner to teach integrating depth processing and depth peeling with conflict detection for more efficient processing of the data to minimize unnecessary processing of fragments, reconsideration and allowance of the claims is requested.

Respectfully submitted,

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